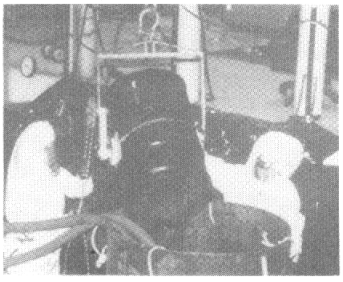
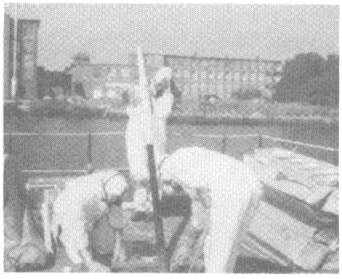
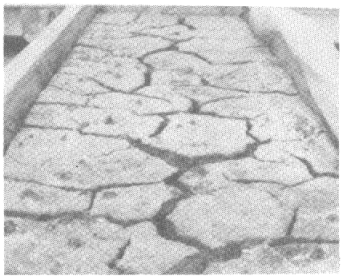
US Army Corps of Engineers







ENVIRONMENTAL LABORATORY

TECHNICAL REPORT EL-88-15

NEW BEDFORD HARBOR SUPERFUND PROJECT, ACUSHNET RIVER ESTUARY ENGINEERING FEASIBILITY STUDY OF DREDGING AND DREDGED MATERIAL DISPOSAL ALTERNATIVES

Report 5

EVALUATION OF LEACHATE QUALITY

by

Tommy E. Myers, James M. Brannon

Environmental Laboratory

DEPARTMENT OF THE ARMY
Waterways Experiment Station, Corps of Engineers
PO Box 631, Vicksburg, Mississippi 39181-0631

April 1989

Report 5 of a Series

Prepared for Environmental Protection Agency
Region 1, Boston, Massachusetts 02203-2211

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) Technical Report EL-88-15	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION USAEWES Environmental Laboratory 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) PO Box 631 Vicksburg, MS 39181-0631	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION US Environmental Protection Agency, Region 1 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code) J. F. Kennedy Federal Building Boston, MA 02203-2211	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification) New Bedford Harbor Superfund Project, Acushnet River Estuary Engineering Feasibility Study of Dredging and Dredged Material Disposal Alternatives; Report 5, Evaluation of Leachate Quality

12. PERSONAL AUTHOR(S)
Myers, Tommy E.; Brannon, James M.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Report 5 of a series	FROM Aug 87 TO Jun 88	April 1989	170

16. SUPPLEMENTARY NOTATION
Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	See reverse.

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

State-of-the-art batch and column leach tests were conducted on anaerobic and aerobic New Bedford Harbor sediment. Batch testing included kinetic tests to determine the time required for dissolved contaminant concentrations to stabilize in batch tests, liquid-to-solids ratio tests to determine the appropriate liquid-to-solids ratio to use in batch tests, and sequential batch leach tests to obtain desorption isotherms and determine distribution coefficients. Column leach tests were conducted in divided-flow permeameters designed to minimize wall effects. Desorption isotherms from sequential batch leach tests and elution curves from permeameter leach tests were used in an integrated approach to obtain information on contaminant release characteristics of New Bedford Harbor sediment.

Desorption of polychlorinated biphenyls (PCBs) and metals from New Bedford Harbor sediment did not follow classical partitioning theory. Therefore, the assumption of

(Continued)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code) / 22c. OFFICE SYMBOL

18. SUBJECT TERMS (Continued).

Confined disposal facility	Leachate	New Bedford Harbor	Superfund
Dredged material	Leaching	Permeameter	
Heavy metals	Mass transport	Polychlorinated biphenyl	

19. ABSTRACT (Continued).

equilibrium-controlled, linear desorption with constant partitioning is not generally applicable to modeling the leaching of contaminants from New Bedford Harbor sediment.

Anaerobic distilled water PCB desorption isotherms showed nonconstant partitioning (negative slopes) to a critical value referred to in this report as the turning point. After the turning point, PCB desorption tended to follow classical, linear partitioning. Sequential leaching with saline water showed that the nonconstant partitioning portion of the PCB desorption isotherms was associated with changing conductivity, and hence salinity. Conductivity-distribution coefficient correlations provided reliable estimates of PCB concentrations as saline pore water was displaced by infiltration of distilled water.

The shape of the observed PCB elution curves from anaerobic permeameter leach tests agreed with the shape of elution curves predicted from batch desorption isotherms. PCB concentrations in the permeameter tests were significantly lower than PCB concentrations in batch leach tests. Possible reasons for these differences were contaminant adsorption to container walls and particle disaggregation effects related to differences in hydraulic regimes in batch and column testing.

Anaerobic metal desorption isotherms also showed nonconstant partitioning, and some metals showed a turning point followed by classical, linear partitioning. Sequential leaching with saline water showed that nonconstant partitioning of metals was apparently independent of conductivity.

The shape of observed metal elution curves from anaerobic permeameter leach tests agreed with the shape of elution curves expected on the basis of batch desorption isotherms for some metals, but for other metals there was no agreement. For some metals, concentrations in permeameter leachate were in good agreement with concentrations in batch leachate, and for other metals, concentrations in permeameter leachate were lower than concentrations in batch leachate.

Sequential batch leach tests with aerobic sediment indicated that large quantities of nickel and zinc will be present in leachate from aerobic sediment. Because aerobic permeameter leach tests did not entirely satisfy aerobic leach testing objectives, aerobic batch and permeameter data were not compared.

PREFACE

This study was conducted as a part of the Acushnet River Estuary Engineering Feasibility Study (EFS) of Dredging and Dredged Material Disposal Alternatives. The US Army Corps of Engineers (USACE) performed the EFS for the US Environmental Protection Agency (USEPA), Region 1, as a component of the comprehensive USEPA Feasibility Study for the New Bedford Harbor Superfund Site, New Bedford, MA. This report, Report 5 of a series, was prepared by the US Army Engineer Waterways Experiment Station (WES) in cooperation with the New England Division (NED), USACE. Coordination and management support was provided by the Omaha District, USACE, and dredging program coordination was provided by the Dredging Division, USACE. This report covers work conducted during the period August 1987 through June 1988.

Project manager for the USEPA was Mr. Frank Ciavattieri. The NED project managers were Messrs. Mark J. Otis and Alan Randall. Omaha District project managers were Messrs. Kevin Mayberry and William Bonneau. Project managers for the WES were Messrs. Norman R. Francingues, Jr., and Daniel E. Averett.

This study was conducted and the report prepared by Mr. Tommy E. Myers of the Water Supply and Waste Treatment Group (WSWTG), Environmental Engineering Division (EED), and Dr. James M. Brannon of the Aquatic Processes and Effects Group (APEG), Ecosystem Research and Simulation Division (ERSD), of the Environmental Laboratory (EL), WES. The Analytical Laboratory Group of the EED, under the supervision of Ms. Ann B. Strong, assisted with chemical analysis of samples. Ms. Cindy Price, APEG, and Mr. Mark Zappi, WSWTG, assisted with laboratory experimentation and sample analysis. Dr. Douglas Gunnison, APEG, conducted the microbial and polychlorinated biphenyl microdroplet investigations. The report was edited by Ms. Jessica S. Ruff of the WES Information Technology Laboratory.

The study was conducted under the general supervision of Mr. Norman R. Francingues, Jr., Chief, WSWTG; Dr. Thomas L. Hart, Chief, APEG; Dr. Raymond L. Montgomery, Chief, EED; Mr. Donald L. Robey, Chief, ERSD; and Dr. John Harrison, Chief, EL.

COL Dwayne G. Lee, EN, was Commander and Director of WES; Dr. Robert W. Whalin was Technical Director.

This report should be cited as follows:

Myers, Tommy E., and Brannon, James M. 1988. "New Bedford Harbor Superfund Project, Acushnet River Estuary Engineering Feasibility Study of Dredging and Dredged Material Disposal Alternatives; Report 5, Evaluation of Leachate Quality," Technical Report EL-88-15, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

CONTENTS